functions obtained for the size and age distributions of all observable craters.

These results are applied to numerical examples relevant to the meteoroidal impact hypothesis of the origin of lunar craters. With certain plausible assumptions it is possible to obtain theoretical expected number densities which agree quite well with observed crater diameter distributions in both the lunar continents and the maria. The most important of these assumptions are:

(1) The underlying size distribution of craters corresponds to bombardment by a population of planetesimals with an asteroidal-type mass distribution.

(2) The rate of filling of continental craters corresponds to the rate of meteoritic accretion.

(3) The rate of filling of craters in the maria is 50 to 100 times greater than that assumed for continental craters, corresponding to the possible filling of mare craters by lava.

Identification of Extragalactic Radio Sources.

THOMAS A. MATTHEWS, *Owens Valley Radio Observatory*.—Preliminary results of a systematic attempt to identify the brighter radio sources on the Palomar Sky Survey plates are now available. The sources have been selected from the existing catalogues so that: (1) declination $\geq -30^\circ$; (2) $S(1420 \text{ Mc/sec}) \geq 3.0 \times 10^{-26} \text{ W m}^{-2} (\text{c/sec})^{-1}$. All known or suspected galactic sources were omitted using their characteristics such as large size, flat radio spectrum, and low galactic latitude.

In this study, accurate positions were available in both coordinates for 75% of the sources from 22^{h} through 12^{h} of right ascension. All the optical objects in the vicinity of the radio source were examined carefully. Objects down to a magnitude of ~ 18 can be recognized as galaxies or star-like, and some of the characteristics of the galaxies can also be determined. Fainter than $m \sim 18$ usually only clustering effects can be reliably noticed, and so the probability decreases that a source can be properly identified.

Of the 119 sources examined, 88 are optically identified with a high degree of certainty. No optical object is visible near the radio source position for 13 of the sources. Ten sources are in crowded fields and more information is needed to make a positive identification. Seventy-five percent of all the sources examined are identified. Considering only those sources free from effects of galactic obscuration, then 83% of the sources can be identified.

The types of optical objects found to be identified with radio sources are: (1) D galaxies, some of them being supergiant systems; (2) a few E galaxies; (3) some "dumbbell" galaxies; (4) a very few peculiar and normal spiral and irregular galaxies; (5) star-

like objects, many of them very blue; (6) N galaxies that have nearly star-like images.

The percentages of the various types of optical objects have also been determined. Since it is difficult to distinguish some D galaxies from E galaxies, especially when the objects are very faint, the two groups have been combined under the heading of "G" for indeterminate objects. Also it is often very difficult to distinguish between N galaxies and QS objects and so all these objects, where no further information is available, have been termed QSN objects.

Type	Percent	Type	Percent
QS	14	D+DE	42
N	2	E+ED	10
QSN	11	G	15
db	2	S, I	4

These percentages hold for the selection of sources described above. If in addition the total power output of the source "L" is calculated, then the relative percentage of the different types of objects depends on "L."

Theory of Lunar Librations Re-Examined.

IRVING MICHELSON, *Illinois Institute of Technology*.—The principal features of lunar rotation were concisely summarized with a high degree of precision by Cassini in 1693 in the set of three empirical laws that are known by his name. Laplace one century later furnished a dynamical theory for the actual small departures of the motion from the idealized form enunciated by Cassini, and suggested measurements from which lunar mass distribution characteristics might be inferred. In modern times Commission 17 of the International Astronomical Union, recognizing the inconclusive character of all such subsequent efforts, has urged the application of a rigorous method for the entire process of data reduction and interpretation. A generalized formulation utilizing contemporary methods of analysis has been carried out which now permits discussion in fundamental dynamical terms of physical librations of the moon and also of artificial satellites in arbitrary elliptic orbits.

Among the features of the lunar motion which were inaccessible on the earlier theory is the dependence of the Cassini motion upon given orbital characteristics (eccentricity and inclination) and inclination of the lunar equator to the ecliptic; this limitation is now removed. Restrictions on small-amplitude librations are also relaxed, both in relation to libration mode coupling and the role of arbitrary principal moment of inertia differences. Finally the complete